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Schott has invested roughly €9 million in its expanded plate glass facilities, including state-of-the-art production technology and a digital infrastructure. Image source: Schott AG.

Digital factory becomes a high-functioning facility

Stephan Schöppler and Alexander Jürgens explain how Siemens' Tecnomatix Plant Simulation software has helped specialty and ceramic glass manufacturer Schott to optimise production at its new flat glass plant in Bolu, Turkey.

Specialty and ceramic glass manufacturer Schott has invested about €9 million in its new flat glass production facilities at its location in Bolu, Turkey. Glass from Schott can withstand oven heat, ensure that cooking surfaces are easy to clean, illuminate shelves in refrigerators and transform extractor hoods into design objects. Subsidiary Schott Orim, located just 500m from the new construction, currently delivers high-calibre flat glass to household appliance manufacturers at home and abroad. To expand its production capacities in Bolu by about 50%, Schott decided to build a new greenfield facility that would start production in spring of 2022 and replace the existing factory.

Factory simulation on a large scale

Schott's glass production caters for mass customisation and the factory's output comprises of relatively small lot sizes and a highly diverse product portfolio. Several thousand different glass products are stacked at the end of the lines and prepared for shipping. "The highly flexible production requires that all the workflows for each order proceed perfectly," says Frank Karbach, Project Manager Lean Management and Technology for flat glass at Schott in Mainz, Germany.

When planning for the expansion at Bolu, "What could possibly be better than simulating all the scenarios?" was Mr Karbach's rhetorical question – answered when, for the first time in Schott's history, an entire glass factory of this size was simulated beforehand. "Meaning that we had a digital factory before the start of physical construction," he explains. Specifically, this involved the simulation, analysis, visualisation and optimisation of production processes, material flows, and logistics workflows on an entire plant floor using Siemens' Tecnomatix Plant Simulation software.

Simulating 'what-if' scenarios

Simulation makes it possible to calculate complex and dynamic workflows in order to make decisions that are more mathematically grounded. A computer model can be used to run important 'what-if' scenarios long before the real system is commissioned. "It's useful to simulate material flows for discrete production processes like those in glass processing when the many dependencies in these processes stretch mathematical descriptions and derivations to their limits," states Stefan Kreuzberger, Project Engineer at Schott. The software also provides analysis tools to identify bottlenecks before or during operation and for analysing human and machine capacity utilisation. ▸

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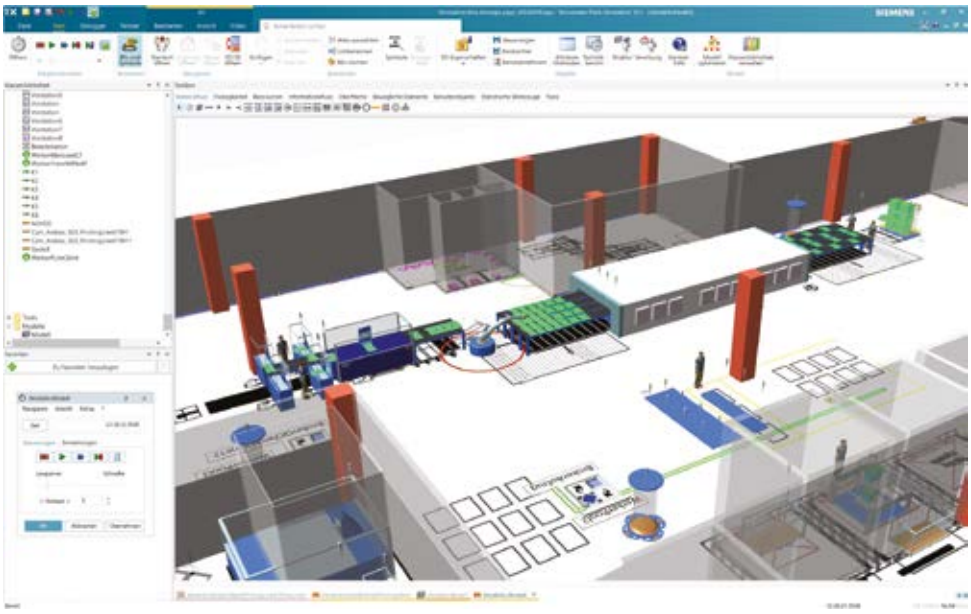
"In the 3D environment, we built a virtual model of the factory layout that we'd previously generated so we could optimise the production facilities themselves, our logistics, our equipment requirements and our material flows with the help of the software," says Mr Kreuzberger. A realistic scenario was recreated in which glass panels measuring 6m x 3m are delivered to Bolu where they're cut, grinded, drilled, printed, and finished. "In the new factory, we'll link a printing line to a tempering process. We were also interested in learning what cycle times will be realistic and what effect a stoppage would have at that position," adds Mr Karbach.

The main goal is to avoid bottlenecks. The simulation showed that the space provided for a particular plant section wasn't optimal. "In the visualisation, we clearly saw that too much was going on at that position; it was too narrow and it could have resulted in collisions," notes Mr Karbach. "If we hadn't noticed this until after actual operation began, it would have been expensive to reposition the machine."



Employing Siemens' simulation software, Schott was able to calculate and optimise processes, material flows and logistics workflows before constructing its new factory. Image source: Schott AG.

This is one of many examples that illustrate the ways that a virtual twin of the factory can generally help prevent all kinds of misdirected investments. "Experts often come up with a particular solution by thinking it through – but a simulation gives us much more certainty, especially when there's a large number of linking systems in the process or new workflows are involved," agrees Mr Kreuzberger. He estimates that thanks to the Plant Simulation, Schott Bolu was able to identify about 30 improvements for the future. For example, the simulation revealed that an automated guided vehicle initially planned for a specific location would, in fact, rarely be used. In this area, calculations indicated that an operator already positioned nearby could perform the logistic steps while waiting for something else to do. In addition, the simulation indicated that the distance between the printing machine and the glass storage area was too far for customer orders with three glass prints (up to seven prints can be executed per panel). According to virtual tests, the optimal procedure would be for the panels to run through the other printers with an empty load and then be stacked. "We can apply all these findings to our other sites with comparable scenarios," observes Mr Karbach.

At its facility in Bolu, Turkey, Schott processes plate glass: for example, oven windows for household appliance manufacturers at home and abroad. Image source: Schott AG.

Conceivable for the future

How can the software be used in actual operation? Schott sees many possibilities. Detailed inspections of specific lines or workstations that don't affect actual glass processing are conceivable. But before things get to that stage, Siemens' Plant Simulation has yet another benefit to offer: it can be used for digital plant commissioning in order to speed up real commissioning. ●

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